REMARKS

This communication is in response to the Office Action mailed on April 30, 2004. In the Office Action, claims 1-20 were pending on which claims 1-20 were rejected.

The Office Action reports that claims 11-13 were rejected under 35 U.S.C. §112. Specifically, the examiner questions why the number of reconstruction filters is determined through the employing step and the solving step since the number of reconstruction filters has already been determined in the determining step. Claims 11 and 12 have been amended to clarify that the steps of determining and employing refer to an estimated number of reconstruction filters and the step of solving refers to an actual number of reconstruction filters. Claim 13 depends on claim 11 and is unchanged.

It is respectfully noted that claims 11-13 have not been rejected substantively based on any art. Therefore, with the clarifications made to this claim set as discussed above, Applicant respectfully submits that claims 11-13 are in condition for allowance.

The Office Action next reports that claims 1-6 were rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,185,309 to Attias (hereinafter Attias). Claim 1 recites in part, a method comprising recording a number of input sound source signals by a number of sound input devices, the number of sound input devices at least equal to the number of input sound source signals, to generate a number of sound input device signals at least equal to the number of input sound source signals, the number of input sound source signals including a target input sound source signal and acoustical factor signals and applying a number of reconstruction filters to the number of sound input device signals according to a convolutional mixing independent component analysis (ICA) to generate at least one reconstructed input sound source signal separating the target input sound source signal from the number of sound input device

signals without permutation, the number of reconstruction filters taking into account a priori knowledge regarding the target input sound source signal, wherein one of the at least one reconstructed input sound source signal corresponds to the target input sound source signal.[emphasis added]

It is respectfully submitted that Attias does not show, teach or suggest at least the features of "the number of reconstruction filters taking into account a priori knowledge regarding the target input sound source signal".

In contrast, Attias discloses in FIG. 2, sensors 15 and 16 that receive the signals generated by the signal sources 11 and 12 in addition to delayed and attenuated versions of the signals generated by the sources [Col. 5, lines 59-62]. Further, Attias provides, that the model for this case, utilizing convolutive mixing, includes a parameter set of spectra S_k and mixing matrix H supplemented by the delay matrix d [Col. 9, lines 63-64]. The resulting filter matrix consists of a series of mixing matrices, one for each time point m and includes elements representing the maximum number of detectable delayed versions, denoted as filter length M [Col. 10, lines 21-26]. Attias also states that "the present invention provides a novel unsupervised learning algorithm for blind source separation of the instantaneous learning mixtures as well as linear and non-linear convoluted mixtures" [Col. 2, lines 27-30].

The present application builds the reconstruction filters based upon knowledge of the type of sound source being targeted. One embodiment utilizes commonly available speech recognition systems where the target sound source is human speech and can be used to indicate if the decorrelated signal is a proper separated signal, or an improper permutated signal, known as the cepstral approach. Claim 1 recites that the reconstruction filters take into account a priori knowledge regarding the target input sound source. As disclosed in the present application, the reconstruction filters utilize "an estimate of the spectrum of the sound source signal that is desired is obtained a priori"

(Page 12, line 23 through Page 13, line 1) and "a priori sound source knowledge allows the convolutional mixing ICA of the invention to reach sound source separation, and not just sound source permutation." (Page 13, lines 3-4). However, no where in the text of Attias can be found the words "a priori knowledge". The method of using a priori knowledge is neither taught nor suggested by Attias and should therefore be allowable.

Paragraph 4 of the Office Action states that Attias discloses a method of applying reconstruction filters according to convolutional independent component analysis (ICA) takes into account a priori knowledge regarding the target sound source signal (column 6, lines 29-52 and column 9, line 51 through column 12, line 50). Applicant respectfully traverses this rejection as Attias does not disclose use of "a priori knowledge" in the convolutional methodology of independent component analysis (ICA), but instead teaches use of the propagation delays that exist between given sources (Column 9, lines 51-54) and the progressively delayed and attenuated versions of the source signal in a reflective environment (Column 10, lines 7-13). Furthermore, the filters operating on the source signals consist of a series of mixing matrices corresponding to each time point that a source signal travels toward a given signal sensor (Column 10, lines 19-24).

Paragraph 7 of the Office Action states that Attias discloses that the a priori knowledge regarding the target input sound signal is an estimate of spectra of the target input sound source signal, citing column 8, lines 1-43. It is respectfully noted that this citation pertains to the instantaneous mixing method of applying independent component analysis, rather than the convolution method to which the present invention is directed, as recited in claim 1 from which claim 6 depends. Furthermore, since Attias does not disclose a priori knowledge, the features recited in claim 6 about a priori knowledge are also not disclosed, taught or suggested by Attias, and therefore is separately patentable.

Paragraph 8 of the Office Action states that Weinstein et al. (US Patent No. 5208786) (hereinafter Weinstein), teaches a method of separating signals used in a speech recognition system, however, its application involves a plurality of detectors for receiving a plurality of observed signals to estimate the transfer function to be used in the reconstruction filter (Column 2, lines 4-12). Additionally, Weinstein teaches production of the reconstruction filters is uncorrelated with no assumptions made about the observed signals (Column 2, lines 12-16). The present application, as described in claim 7, compares the measured source signals to a set of predetermined values (words or speech pattern vectors) as described above which is neither taught nor suggested by either Attias or Weinstein, and therefore is separately patentable.

Claims 8-10 and 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Attias in view of Hosoda et. al. (US Patent No. 5727122) (hereinafter Hosoda). Hosoda teaches a method of linear predictive coding and decoding to provide high quality regenerated speech signals for voice patterns having strong periodicity and to employ a lower coding rate as required by some communication systems (Column 1, line 44 through Column 2, line 16). Hosoda neither teaches nor suggests analysis of multiple sources wherein blind source separation is used to separate a target source from a multiple of other sources.

Examiner suggests that Attias and Hosoda are from the same field of endeavors and therefore obvious to combine their respective teachings. Applicant traverses this position as Attias teaches separating a source from multiple sources coupled with delayed renditions of the signal of interest using different methods of independent component analysis (ICA) whereas Hosoda teaches coding and decoding of a speech recording from a known source to provide quality reproduction at lower coding rates. There is no reason to combine these two references so therefore the elements as described in claims 8 and 9 when combined with claim 1 are patentable.

Paragraph 11 of the Office Action states that it would have been obvious to implement the method of claim 1 in a software program. Applicant notes that claim 1 as amended is patentable and considering that claim 10 depends from claim 1 it is therefore allowable.

In Paragraph 12 with respect to claim 14, the Office Action states that Attias discloses a method for constructing a number of reconstruction filters to separate a target sound source without permutation according to convolutional mixing method of independent component analysis (ICA) (Column 6, lines 29-52 and Column 9, line 51 to Column 12, line 50). Although Attias uses convolutional mixing as part of the invention, what is further utilized is the focus on delayed versions of the target, as well as other source signals, detected by the sound input devices. This does not address the permutation problem, which is part of the present application (Page 13, lines 3-12. The Office Action acknowledges that Attias does not disclose a method for determining a prediction error based on a vector quantization, and instead cites Hosoda for this teaching, contending that one can combine the teachings of each to realize the invention recited by claim 14. However, as stated above, Hosoda teaches a method of linear predictive coding and decoding to provide high quality regenerated speech signals for voice patterns having strong periodicity and to employ a lower coding rate as required by some communication systems (Column 1, line 44 through Column 2, line 16). Hosoda neither teaches nor suggests analysis of multiple sources wherein blind source separation is used to separate a target source from a multiple of other sources. Thus, to conclude that claim 14 is not patentable one must totally disregard the specific teachings of Attias for separating sound sources and substitute in its place the apparent teachings of Hosoda, while further dealing with multiple sound source signals. It is respectfully believed this conclusion can not be sustained based on the disclosures of Attias and Hosoda.

Withdrawal of the rejection and allowance of the claim 14 is respectfully requested.

Paragraph 13 of the Office Action rejects claim 15, stating that Attias discloses a method for encapsulating a priori knowledge of the target input sound source signal, however, as explained in the previous response to claim 1, which is incorporated herein, a priori knowledge is neither utilized nor suggested by the teachings of Attias.

Paragraph 14 of the Office Action rejects claim 16, stating that Attias does not disclose vectors of linear prediction (LPC) and therefore concludes reason to combine with the teachings of Hosoda. However, Applicant has previously traversed any reason to combine these two references due to the difference in analysis and separate field of endeavors.

Paragraph 15 of the Office Action states that Attias does not disclose a method for solving the prediction error using expectation maximization (EM) nor using an E-step of the EM approach to determine the best codeword within the VQ codebook. Examiner further suggests that it is obvious to combine the teachings of Attias with Hosoda, however for the reasons stated above, there is no reason to combine said references.

Paragraph 16 of the Office Action states that it would have been obvious to implement the method of claim 20 in a software program. Applicant notes that claim 14 is patentable and considering that claim 20 depends from claim 14 it is therefore allowable.

Applicant respectfully submits that claims have been amended for clarity and should be allowable, dependent claims are also allowable by virtue of their dependency, either directly or indirectly from allowable independent claims or by way of separate patentability.

The Director is authorized to charge any fee deficiency required by this paper or credit any overpayment to Deposit Account No. 23-1123.

Respectfully submitted,

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